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NITROSAMINES

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See also back page

7 T 202
Diethylnitrosamine and other N-nitrosamines in foods.
Sen, N. P.; Smith, D. C.; Schwinghamer, L.; Marleau, J. J.
Journal of the Association of Official Analytical Chemists 52 (1) 47-52 (1969) [29 ref. En] [Res. Lab., Food and Drug Directorate, Dept. of Nat. Health and Welfare, Ottawa, Ontario, Canada]
Dimethyl-, diethyl-, di-n-propyl, and other nitrosamines in foods are determined semiquantitatively as follows: (a) initial extraction of the nitrosamines from foods into suitable solvents, (b) isolation of the nitrosamines from other interfering materials by steam distillation and ion exchange cleanup, (c) detection and semi-quantitative estimation by thin layer chromatography, and (d) final identification by gas liquid chromatography of the separated compounds. The detection limit for dimethyl-nitrosamine in foods was 0.15 ppm and for diethyl- and di-n-propyl-nitrosamines, 50 parts/billion. The method has been successfully applied to wheat flour, fish, cheese, and spinach samples. AS

9 J 830
Carcinogen in a Transkeian Bantu food additive. [A letter]
Du Plessis, L. S.; Nunn, J. R.; Roach, W. A.
Nature (London) 222 (5199) 1198-99 (1969) [8 ref. En] [Dept. of Chemistry, Rhodes Univ., Grahamstown, R. of S. Africa]
As a result of a search for carcinogenic nitrosamines in Bantu food plants, dimethylnitrosamine was shown to be present in the fruits of Solanum incanum. The juice of these fruits is used by headboys to curdle milk, the resulting curds being their chief source of sustenance during the day. MEG

9 M 633
Nitrosamines in wheat flour.
Thewlis, B. H.
Food and Cosmetics Toxicology 6 (6) 822-23 (1968) [En] [Flour Milling & Baking Res. Association, Old London Rd., St. Albans, Hertfordshire, England]
Several authors have reported the presence of the carcingoen, diethylnitrosamine (i) in samples of flour produced commercially in Germany and England. In each case suspected nitrosamine was separated by thin layer chromatography (TLC), irradiated with UV light, when nitric oxide was liberated and a 'nitrite' reaction obtained with the spray reagents used. The author draws attention to a larger spot surrounding the (i) spot. The spot, which occurred when flour to which (i) had been added was examined, consisted of substances, probably phenols, which had the same R_f value as (i). A faint spot arose on the site of the flourescent substances which was easily distinguishable from (i) and may be due to a reaction between phenolic substances in the flour and nitrite in the atm. The author therefore recommends careful purification of the extracts before TLC, so eliminating misleading effects due to phenols. VJG

21 C 6
Formation of N-nitrosamines from secondary amines and nitrite in human and animal gastric juice.
Sen, N. P.; Smith, D. C.; Schwinghamer, L.
Food and Cosmetics Toxicology 7 (4) 301-07 (1969) [16 ref. En, fr, de] [Res. Lab., Food and Drug Directorate, Dept. of Nat. Health and Welfare, Tunney's Pasture, Ottawa 3, Ontario, Canada]

A study was made of the possible formation of diethylnitrosamine (DEN) from nitrite and diethylamine in the acidic environment of the stomach of humans and various lab. animals. The in vitro formation of DEN was demonstrated when diethylamine and sodium nitrite were incubated with gastric juices from rats, rabbits, cats, dogs and man. Human and rabbit juices (pH 1-2) produced more DEN than did rat gastric juice (pH 4-5). The nitrosation reaction has been shown to occur in vivo in cats and rabbits. The yields of DEN were low but the identity of the DEN formed was confirmed by both thin-layer and gas chromatography. The possible formation of traces of nitrosamines over a prolonged period under the acid conditions prevailing in the stomach could constitute a hazard to human health. It is suggested that, for the further tests necessary to establish whether a significant hazard does exist, the rabbit, cat, or ferret, with gastric juices similar in pH to that of man, may be more suitable test species than the rat. AS

3 C 69
Nitrosamines as environmental carcinogens. [A review]
Lijinsky, W.; Epstein, S. S.
Nature (London) 225 (5227) 21-23 (1970) [23 ref. En] [Eppley Inst. for Res. in Cancer, Coll. of Med., Univ., Lincoln, Nebraska, USA]

Human cancer might be caused by nitrosamines formed in the body from ingested nitrites and secondary amines. Cooking could be a source of secondary amines. AS

6 C 142
Occurrence of diethylnitrosamine in some samples of food.
Hedler, L.; Marquardt, P.
Food and Cosmetics Toxicology 6 (3) 341-48 (1968) [13 ref. En] [Abteilung für experimentelle Therapie, Univ., Hungstetter-Str. 55, Freiburg/Breisgau, W. Germany]

The presence of diethylnitrosamine in (i) wheat plant, (ii) wheat grain, (iii) wheat flour, (iv) milk and (v) cheese has been confirmed by thin layer chromatography. Degree of concn. necessary in 500 g initial product for the qualitative determination of nitrosamine (of the order 100 μg) is (total number of samples and number of samples containing nitrosamine being given in parentheses): (i) 20 000 times (9, 9); (ii) 9000 (2, 2); (iii) unheated, 5000 (3, 3); (iii) heated at 175°C, 1400 (30, 22); (iv) 8000, (1, 1); (v) 250 and 500 (2, 2). VJG

6 C 152
[N-nitrosamines in food.]
Keybets, M. J. H.; Groot, E. H.; Keller, G. H. M.
Voeding 31 (2) 64-67 (1970) [21 ref. Nl, en] [Afdeling Voeding en Voedselbereiding der Landbouwhogeschool, Wageningen, The Nether

Presence of nitrosamines in nitrite-containing spinach could not be determined with the test methods employed (not given in detail), which h detection limits of 0.5 mg dimethyl- and 0.08 m diethylnitrosamine/kg. Literature on possibility of toxicity of wheat flour, pasteurized milk and cheese is briefly reviewed. HBr

9 A 281
Separation and detection of volatile and non-volatile N-nitrosamines.
Walters, C. L.; Johnson, E. M.; Ray, N.
Analyst 95 (1130) 485-89 (1970) [9 ref. En] [British Food Manufacturing Ind. Res. Associati Randalls Road, Leatherhead, Surrey, England]

The detection of small concn. of N-nitrosamines in biological materials requires their prior selective extraction and concn. A procedure is described for the separation of both volatile and non-volatile N-nitrosamines as a class, and their subsequent determination at low levels. N-nitrosamines are adsorbed from aqueou solution on to activated C from which many can desorbed to varying extents by refluxing with methanol. 2 sensitive techniques are used for the determination of separated N-nitrosamines, name differential polarography at acid pH and the release of nitrite on UV irradiation at alkaline pH in the manner of Daiber and Preussm [Z. analyt. Chem. (1964) 206: 344]. The properties of N-nitrosamines and related compou are compared and methods of differentiating between the groups of compounds are discussed.

9 J 894
An investigation into the possible presence of nitrosamines in nitrite-bearing spinach.
Keybets, M. J. H.; Groot, E. H.; Keller, G. H. M.
Food and Cosmetics Toxicology 8 (2) 167-71 (1970 [29 ref. En, fr, de] [Dept. of Food and Nutrition, Agric. Univ., Wageningen, The Netherlands]

Within the limits of detection of the analysis used (0.1-0.5 ppm), no nitrosamines were demonstrable in nitrite-bearing spinach. It was, however, possible to demonstrate minute amounts diethylnitrosamine under very extreme experimen conditions, e.g. extremely high diethylamine concn. The effects of temp., duration of reaction and pH on nitrosamine synthesis were also studied. Both the weakly alkaline reaction of spinach and the low concn. of secondary amines are important factors limiting the synthesis of nitrosamines, even in spinach with a high nitrite concn. AS

) R 346
xtraction and gas chromatographic
etermination of N-nitrosodimethylamine in smoked
sh: application to smoked nitrite-treated chub.
loward, J. W.; Fazio, T.; Watts, J. O.
ournal of the Association of Official Analytical
hemists 53 (2) 269-74 (1970) [29 ref. En]
Division of Food Chem. and Technology Food and
rug Administration, Washington, DC 20204, USA]
N-nitrosodimethylamine can be determined in
noked nitrite-treated chub fish as follows: The
sh sample is digested in methanolic KOH; the
itrosamine is distilled from alkaline solution,
rther isolated by extraction and column
nromatographic techniques, and determined by GLC
ith a modified thermionic detector. Recoveries of
I-nitrosodimethylamine added at levels of 10 ppb
nged from 70-86%. The application of the
rocedure to the analysis of 5 experimental
ots of smoked nitrite-treated chubs indicates
nat N-nitrosodimtehylamine is not produced in the
esh under the conditions of the processing
reatment used. AS

0 R 356
ormation of nitrosamines in nitrite-treated fish.
en, N. P.; Smith, D. C.; Schwinghamer, L.;
Iowsam, B.
Canadian Institute of Food Technology Journal 3
2) 66-69 (1970) [16 ref. En, fr] [Res. Lab., Food
nd Drug Directorate, Ottawa 3, Canada]
Sodium nitrite, widely used as a preservative,
eacts with various methylamines present in
ish to give nitrosamines, such as
imethylnitrosamine, which are potent carcinogens.
The methods developed for extracting and
letermining nitrosamines from smoked fish are
lescribed with expt. details. Nitrosamines were
letected in all samples containing nitrite.
Nitrite addition to fish is not permitted in
Canad- PC

1 C 258
econdary amines in cooking. [A letter]
Courts, A.
Nature (London) 225 (5229) 302 (1970) [4 ref. En]
Gelatine and Glue Res. Association, Birmingham
2, England]
The comment by Lijinsky and Epstein [FSTA (1970)
3C69] that cooking of protein could result in
production of secondary amines, which would
hen be converted by nitrite present in the
tomach into carcinogenic materials, is disputed.
Research experience with collagen (the imino and
mino acid content of typical bovine collagen
ncludes 14% proline, 14% hydroxyproline and 8%
rginine) has shown that after cooking at 60-
00°C no free amino acids or small peptides were
letected. It is thought unlikely that ingestion of
lecayed meat or fish would constitute a secondary
mine source. AL

11 R 406
The possible nitrosation of amines in smoked chub.
Malins, D. C.; Roubal, W. T.; Robisch, P. A.
Journal of Agricultural and Food Chemistry 18 (4)
740-41 (1970) [9 ref. En] [Bureau of Commercial
Fisheries, Pioneer Res. Lab., 2725 Montlake Blvd.
East, Seattle, Washington 98102, USA]
Studies were undertaken on the formation of dimethylnitrosamine (dmna) in aqueous model systems containing methylamines and sodium nitrite. The reaction conditions (pH, reaction time, and temp.) were more severe than those occurring during the commercial processing of nitrite treated smoked chub. Polarographic analyses indicated that detectable amounts of dmna (1.4×10^{-8} mole) were not produced. It was concluded that in all probability dmna does not form in concn. greater than 10 parts/billion during the smoking process. AS

12 P 1793
Is there a connection between the occurrence of nitrite-producing micro-organisms in cheese and the formation of nitrosamine?
Lembke, A.; Moebus, O.
International Dairy Congress (18th, Sydney) 1E: 139 (1970) [4 ref. En] [Inst. für Mikrobiologie, Bundesanstalt für Milchforschung, Kiel, W. Germany]
The presence of nitrosamines in cheese, as determined by UV-degradation of the nitroso group and photochemical estimation of nitrite, did not appear to be related to the occurrence of nitrate-reducing micro-organisms. CDA

VOLUME 3

2 C 26
Gas-liquid chromatographic determination of dimethylnitrosamine as dimethylnitramine at picogram levels.
Sen, N. P.
Journal of Chromatography 51 (2) 301-04 (1970) [17 ref. En] [Food and Drug Res. Lab., Dept. of Nat. Health and Welfare, Ottawa, Ontario, Canada]
Dimethylnitrosamine (DMN) was oxidized to dimethylnitramine (DMNA) using a 5:4 mixture of trifluoroacetic acid and 50% H_2O_2. GLC analysis of DMNA used a Varian Aerograph gas chromatograph, Model 1200, equipped with an electron capture detector and a 1 mV recorder. A stainless steel column, 6 ft × 1/8 in, was packed with 10% Carbowax 20M on 60-80 mesh Chromosorb W (HMDS treated). Column temp. was 152°C, injector 225°C, detector 210°C, and N_2 flow 24 ml/min. Under these conditions 8 pg of DMNA (or 16 pg DMN) could be detected. The peak heights were proportional to the amount of DMNA at least up to 100 pg. The % conversion of DMN to DMNA varied with experiment conditions but results were reproducible. This technique can be used to confirm the identity of nitrosamines isolated from foods but proper clean-up procedures need to be developed so that it can be applied directly to food extracts. Application of the method to nitrite-treated, smoked hake is described. MHEG

2 S 117
[The influence of different factors on the formation of nitrosamines in meat products.]
Einfluss verschiedener Faktoren auf die Bildung von Nitrosaminen in Fleischerzeugnissen.
Möhler, K.; Mayrhofer, O. L.
Proceedings of the European Meeting of Meat Research Workers 15: 302-04; (summ. III) 74 (1969) [6 ref. Re, en, ru] [Deutsche Forschungsanstalt für Lebensmittelchemie, Munich, W. Germany]
The formation of nitrosamines in meat was studied by reaction of diethylamine with nitrite under varying conditions. The addition of glycine in the pH range 4.2-7 resulted in a sharp, almost complete inhibition of nitrosamine formation in a diethylamine/$NaNO_2$ mixture. It is considered that salt formation between glycine and nitrite largely restricts the dissociation of the nitrite and the formation of free nitric acid. It is concluded that the addition of $NaNO_2$ and $NaNO_3$ to foodstuffs should be restricted to a max. of 10 ppm to avoid the synthesis of highly carcinogenic nitrosamines with short alkyl chains. HSi

3 A 139
Gas chromatography and selective detection of N-nitrosamines.
Rhoades, J. W.; Johnson, D. E.
Journal of Chromatographic Science 8 (10) 616-17 (1970) [4 ref. En] [Southwest Res. Inst., 8500 Culebra Road, San Antonio, Texas 78228, USA]
A detection system which is selective for the N-nitrosamines is reported. It is suggested that the procedure might be applied to samples of foods and beverages. AB

3 G 92
SOS/70. 3rd International Congress of Food Scie and Technology, Washington, DC, Aug. 9-14, 197 Abstracts of papers. General Session. [Volunteer papers]
Jul, M. (United States of America, Institute of Food Technologists) (Chairman)
Abstracts 15, 16, 18. 19, 20, 21, 22, 23, 24, 25, 26 & 27 (1970) [En]
Abstracts are presented of the following papers: Food science and technology research in the Federal Republic of Germany, by F. Krusen; Soul foods and survival, by L. Boykin & R. Mirenda; A organoleptic assessment of some convenience food used in mass feeding operations, by M. A. Hill, J. F. Armstrong & G. Glew; Integrated power/water/food facilities, by C. O. Hodge & C. N. Hodges; The formose reaction, A. Weiss; A study of the phototoxicity induced in rats by pyropheophorbide A, by M. H. Love, G. C. Jersey & S. H. Schanderl; Interaction between milk proteins and phosphates, by M Fukushima & J. M. de Man; Determination of nitrosamines in foods, by S. R. Tannenbaum, P. Issenberg, J. Rogers & T. Y. Fan; Lipoxygenase activity in different varieties of green peas, by P. Dupuy & J. Rigaud; Space food technology: a review, by H. A. Hollender, M. V. Klicka, G. Legris & M. C. Smith; Can dietary phenolic antioxidants prevent lung disease? by J. N. Roehm, J. H. Hadley & O. B. Menzel; Thermal reactions of dichlorodiphenyltrichloroethane (DDT) and its transformation products with food ingredients, by J. W. Ralls & A. Cortes; and Intensity of biotransformation of lindane in macro organisms and its influence upon several biochemical processes, by Z. Stary. JA

4 C 71
The gas chromatographic determination of nitrosamines at the picogram level by conversion to their corresponding nitramines.
Althorpe, J.; Goddard, D. A.; Sissons, D. J Telling, G. M.
Journal of Chromatography 53 (2) 371-73 (1970) [1 ref. En] [Unilever Res. Lab., Colworth House, Sharnbrook, Beds, UK]
See also FSTA (1971) 3 2C26.

4 P 668
Nitrosamines in cheese?
Ginfel, J. G. van
International Dairy Federation Annual Bulletin 1970 (6) 45pp. (1970) [23 ref. En & Fr]
After a brief account of nitrosamines as carcinogenic factors, the possibility of their presence in cheese is discussed. Addition of nitrate to milk had no correlation with the appearance of nitrosamines in the cheese, and presence of nitrosamines, as indicated by TLC, was at such low levels that no significance could be attached to the chromatographic results as proof of their presence. It is concluded that the question of whether nitrosamines occur in cheese in very small quantities (<0.1 ppm) must be left unanswered at present. CDA

C 83
Occurrence of nitrosamines in foods.] Zum Auftreten von Nitrosaminen in Lebensmitteln.
Freimuth, U.; Gläser, E.
Nahrung 14 (5) 357-61 (1970) [25 ref. De, en, ru] Sektion Chemie, Bereich Lebensmittelchemie und Mikrochem. Lab., Tech. Univ., Dresden, E. Germany]
Commercial samples of cheese, anchovy paste, cured meat (Kasslertype) and pumpernickel were analysed for nitrosamines. Dimethylnitrosamine (20 μg/kg) and traces of diethylnitrosamine were found in 1q sample of Tollenser cheese. Cured meat (Kassler) contained diethylnitrosamine (max. value: 40μg/kg). Nitrosamines occurred only in isolated instances. IN

C 103
Possible formation of toxic and in particular carcinogenic compounds in food of animal origin as a result of technological processing.] Möglichkeiten der Bildung von toxischen, insbesondere kanzerogenen Stoffen in Lebensmitteln tierischer Herkunft durch technologische Verfahren. [A lecture]
Möhler, K.
Wiener Tierärztliche Monatsschrift 57 (10) 321-25 (1970) [16 ref. De, en] [Analytische Abteilung, Forschungsanstalt für Lebensmittelchemie, D-8050 Munich-Weihenstephan, W. Germany]
Following a brief discussion of the possible occurrence in foods of toxic compounds, arising from microbial contamination, preservatives, cleaning agents, disinfectants and browning reactions, the author discusses in more detail the possible occurrence of carcinogenic compounds (including polycyclic hydrocarbons) in foods, particularly nitrosamines during curing of meat with nitrate. Topics covered include isolation, identification, carcinogenic activity, formation mechanism and properties of the compounds. JA

A 254
Pyrazines as interfering substances in the determination of nitrosamines in roasted foods.
Kadar, R.; Devik, O. G.
Acta Chemica Scandinavica 24 (8) 2943-48 (1970) [21 ref. En] [SINTEF, Eng. Res. Foundation, Tech. Univ., Trondheim, Norway]
Distillates with nitrosamine-like properties as characterized by polarography were obtained from model systems of D-glucose and glycine subjected to more or less prolonged heating, and fractionated by means of gas chromatography. In total 7 fractions were obtained and the same fractions were found in a number of typical roasted foods. The fractions were identified as various simple alkyl substituted pyrazines by means of their NMR and spectra, and their UV absorption spectra. AS

C 123
A specific analytical method for separation and identification of nitrosamines by combination of capillary gas chromatography and mass spectrometry.] Ein spezifisches analytisches Trenn- und Nachweisverfahren für Nitrosamine durch Kombination von Capillargaschromatographie und Massenspektrometrie.
Heyns, K.; Röper, H.
Zeitschrift für Lebensmitteluntersuchung und - Forschung 145 (2) 69-75 (1971) [23 ref. De, en] [Inst. für Organische Chem. und Biochem., Univ., Hamburg, W. Germany]

7 C 124
[Formation of nitrosamines by reaction of monosaccharides with amino acids (Maillard reaction).] Zur Frage der Entstehung von Nitrosaminen bei der Reaktion von Monosacchariden mit Aminosäuren (Maillard-Reaktion).
Heyns, K.; Koch, H.
Zeitschrift für Lebensmitteluntersuchung und - Forschung 145 (2) 76-84 (1971) [26 ref. De, en] [Inst. für Organische Chem. und Biochem., Univ., Hamburg, W. Germany]

8 C 143
Conditions and chemical reaction mechanisms by which nitrosamines may be formed in biological products with reference to their possible occurrence in food products.
Ender, F; Ceh, L.
Zeitschrift für Lebensmitteluntersuchung und - Forschung 145 (3) 133-42 (1971 [17 ref. En, de] [Dept. of Biochem., Vet. Coll., Oslo, Norway.]
Model experiments were carried out in which high concn. of $NaNO_2$ were allowed to react with alkylamines, amino acids, and proteins from meat and freshwater fish. It was found that large amounts of nitrosamines, especially dimethylnitrosamine, were produced from these reactions under suitable conditions related to pH, temp., time of reaction, and the presence of a protecting colloid, These details and the nitrosamines formed are tabulated. In cases where large amounts of nitrosamines were formed the toxicity of these compounds was demonstrated with mink as test animals. Colorimetric methods for determination of nitrosamines are given in detail. The occurence of $NaNO_2$ in foods is discussed in relation to formation of nitrosamines. A list of foods having a wide variation in nitrite content is given. Relatively high levels are present in smoked fish, sausages and ham. MHEG

8 R 358
Gas chromatographic determination and mass spectrometric confirmation of N-nitrosodimethylamine in smoke-processed marine fish.
Fazio, T.; Damico, J. N.; Howard, J. W.; White, R. H.; Watts, J. O.
Journal of Agricultural and Food Chemistry 19 (2) 250-53 (1971) [17 ref. En] [Div. of Food Chem. and Tech., Bureau of Foods and Pesticides, FDA, Washington, DC 20204, USA]
The gas chromatographic method for determination of N-nitrosodimethylamine in smoked nitrite-treated chub fish [see FSTA (1970) 2 10R346] has been modified to include other species of fish. The nitrosamine, confirmed by mass spectrometry, was isolated from samples of

raw, smoked, and smoked nitrite- and/or nitrate-treated sable, salmon, and shad. Levels of N-nitrosodimethylamine found ranged from 4 to 26 μg/sg. AS

9 P 1497
[Mechanism of nitrosamine formation in cheese.] Über den Bildungsmechanismus der Nitrosamine im Käse.
Lembke, A.; Frahm, H.; Moebus, O.; Wasserfall, F.
Deutsche Molkerei-Zeitung 92 (15) 629-38 (1971) [22 ref. De] [Inst. für Mikrobiol., Bundesanstalt für Milchforschung, Kiel, W. Germany]

Presence of nitrosamines in cheese, possibly caused by interaction between amines and nitrite derived from added nitrate, was investigated by TLC. The results indicated however, that nitrosamines, where apparently present, were not in general accompanied by nitrate or nitrite, and further that apparent presence of nitrosamines was frequently not confirmed by that of the nitrite and amines which, expectedly, should result from their breakdown by UV irradiation. Reduction of nitrate to nitrite by bacterial action or by xanthine oxidase did not appear to be responsible for nitrosamine formation. Nitrosamine-like substances were, however, more plentifully present in mould than in non-mould cheeses. Their formation in cheese may perhaps result from nitrate assimilation by certain organisms. GTP

10 A 456
N-Nitrosamines not identified from heat induced glucose/L-alanine reactions.
Scanlan, R. A.; Libbey, L. M.
Journal of Agricultural and Food Chemistry 19 (3) 570-571 (1971) [7 ref. En] [Dept. of Food Sci. and Tech., St. Univ., Corvallis, Oregon 97331, USA]

D-Glucose and L-alanine were absorbed on potato starch, heated, and the products vacuum distilled. Dichloromethane extracts of the aqueous distillates were analysed by tandem gas chromatography-mass spectrometry. No evidence for the presence of the carcinogenic, lower mol. wt. dialkylnitrosamines was found. AS

11 A 515
The formation of methyl substituted pyrazines in the Maillard reaction, and the interference by such compounds in the determination of N-nitrosamines in foodstuffs.
Havre, G. N.; Ender, F.
Zeitschrift für Lebensmitteluntersuchung und -Forschung 146 (2) 74-79 (1971) [15 ref. En, de] [Dept. of Biochem., Vet. Coll., Oslo, Norway]

The formation of methyl substituted pyrazines in the Maillard reaction between L-alanine and D-glucose is confirmed in studies using mass spectroscopy. These pyrazine compounds are known to interfere in determinations of N-nitrosamines, particularly if gas chromatographic and polagraphic methods are used. It is shown that the colorimetric determination of the volatile N-nitrosamines is selective and sensitive provided suitable clean up procedures are observed. JML

12 H 1826
Observations on the detection of dimethyl- and diethyl-nitrosamines in foods with particular reference to alcoholic beverages.
Williams, A. A.; Timberlake, C. F.; Tucknott, O. G.; Patterson, R. L. S.
Journal of the Science of Food and Agriculture 2 (8) 431-434 (1971) [21 ref. En] [Res. Sta., Long Ashton, Bristol, UK]

Simple polarographic and gas chromatographic methods commonly used for the detection of nitrosamines in model systems have been found to be inadequate when applied to a potable spirit. Although these methods indicated the possible presence of nitrosamines in the spirit, gas chromatography combined with mass spectro showed that compounds other than nitrosamines responsible for the putative chromatographic peaks. After isolation by preparative gas chromatography, the compound responsible for t polarographic activity, interpreted as nitrosamine in the unconcentrated spirit, was shown to be furfural. AS

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13.	Deep Fat Frying	400	£4.00	☐	248	£2.50	☐	£7.00 ☐
14.	Viscosity of Foods	399	£4.00	☐	212	£2.50	☐	£7.00 ☐
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